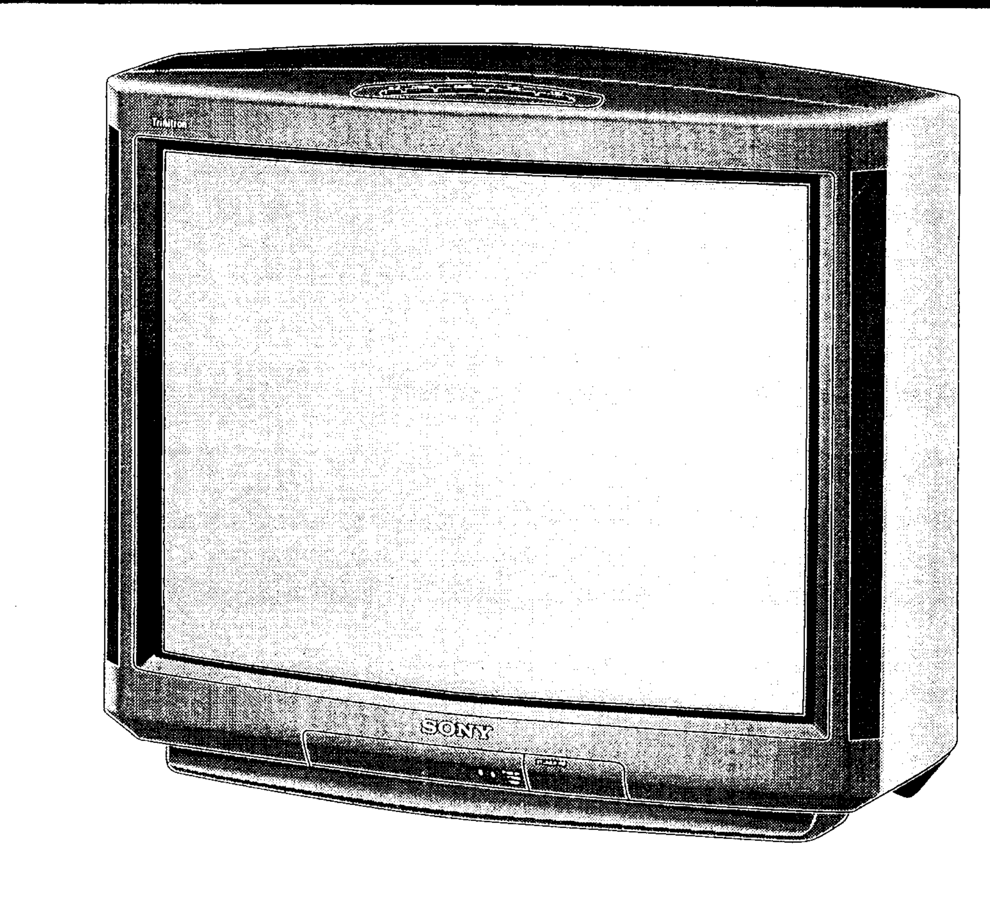
SONY ®

Training Manual



Color Television

AA-2/BA-3 Chassis

Circuit Description & Troubleshooting

Course:CTV-24R1

Sony AA-2 Direct View TV Chassis Features

MODEL	Inception	Audio/Video Inputs	Audio/Video Outputs	1 tuner PIP	2 tuner PIP	Rm light Sensor Clock, S link	Tilt Correction	Surround Sound	SRS Sound Retrieval
KV27S20	Feb-96	1	audio only					x	
KV27S22	97	1	audio only					x	
KV27S25	Feb-96	2	audio only	x				x	
KV27S26	97		audio only	x				x	
KV27S35	Sep-96	2	audio only		x			x	
KV27S36	97		audio only		x			x	
KV27V20	Jul-96	2	1					x	x
KV27V22	97	2	audio only			x		x	x
KV27V25	Jul-96	3	1	x		x		x	x
KV27V26	97	3	1	x		x		x	x
KV27V35	Jul-96	3	1		x	x		x	x
KV27V36	97	3	1		x •	x		x	x
KV32S20	Mar-96	1	audio only					x	
KV32S22	97	1	audio only					x	
KV32S25	Mar-96	2	audio only	x				x	
KV32S26	97		audio only	x				x	
KV32S35	Sep-96	2	audio only		x			x	
KV32S36	97		audio only		x			x	
KV32V25	Jul-96	3	1	x		x		x	x
KV32V26	97	2	1	x		x		x	x
KV32V35	Jul-96	3	1		x	x		x	x
KV32V36	97	3	1		x	x		x	x
KV35S26	97		audio only	x			?	x	
KV35S36	97		audio only		x		?	x	
KV35V35	May-96	3	1		x	x	x	x	x
KV35V36	97	3	1		x	x	?	x	x
KV35V75	May-96	3	1		x	x	x	x	x
KV35V76	97	3	1		x	x	?	x	x

INTRODUCTION

Purpose
This book is made for the experienced service technician to help him/her understand how the circuitry for Sony's new AA-2 and 20" screen BA-3 direct view TV chassis works, from a servicing standpoint.

Layout
This book is laid out with simplified diagrams and circuitry description in the order of the TV set's operation. The operational order chosen is from TV plug in to a picture appearing on the screen.

The simplified diagrams of the video and audio processing show signal flow with muting locations. These mute stages are more common place in this TV because most of this TV's stages are always powered (as long as the set is plugged in to AC). Therefore at power OFF, when only the Jungle IC powers down, the remaining stages are still active, which would amplify popping sounds (noise) if it were not for the muting circuits. The muting circuits are controlled by the Syscon/Micon IC that is always powered even after the set is turned OFF.

Text
For each simplified diagram, a simplified overview is provided to take you rapidly through each stage. After the overview, a detailed circuit description is provided with in-depth information. Following this are troubleshooting hints, which contains strategies, symptoms, and/or voltages in a defective and the normal state. This aids you in determining if the voltage you have is closer to the normal or defective voltage.

New Circuits
In the AA-2 chassis, Sony has taken a departure from previous chassis designs of these stages, which will affect your troubleshooting:

1. Power distribution,
2. Protection,
3. Blanking, and
4. Video distribution.

Tilt Correction Feature
The circuitry for this feature is not shown in this book. It is found only in the 35" TVs and it has only a few discrete devices. It is software controlled by the main System Control Microprocessor (Micon). At power ON, Micon outputs serial data that is fed into a digital to analog converter IC that outputs a DC voltage to the velocity modulation circuit board at the CRT neck. The output of the buffer on this board is a DC voltage to a coil wrapped around the neck of the CRT.

Picture tilt (rotation) is achieved by applying DC current to this CRT neck coil. As the 3 electron beams from the cathode pass through the magnetic field created by the coil, they are twisted/rotated thus rotating the picture. The greater the coil current, the more the rotation.

Room Light Sensor / Lumisponder Feature
This circuit has a photocell IC at the front panel board that monitors the ambient room light and adjusts the picture level accordingly. For example, if the viewer shuts off the room light, the TV will reduce picture level (contrast and color) accordingly so the picture does not appear excessively bright.

S-Link Feature
When connected to a VCR that also has this feature, via a 3.5mm mini plug cable, it allows the viewer to press just the play button on the VCR to view the tape. The VCR outputs serial data to turn ON the TV and change to the designated video input to view this VCR.

Matrix Surround Sound Feature
Turned ON/OFF from the menu, this takes the normal audio and simulates the sound quality of a concert Hall or Movie theater using the TV's built in speakers.

SRS = Sound Retrieval System Feature
Operates in both stereo and mono to widen the soundstage, recover subtleties present in the original performance. Uses the built in TV speakers to recreate the realism of live sound by equalizing and positioning sounds in three dimensional space.

BLOCK DIAGRAM

Overview

The AA-2 direct view TV chassis differs from the previous Sony TV sets in the start-up operation and in the Picture-in-Picture signal flow. This TV set starts by switching on only the 9V power supply, since all of the other power supply voltages are always active, as long as the set is plugged in. This TV starts up when System Controls/Micon tells the +9Vdc supply to switch ON permitting the Jungle IC to start the horizontal oscillator and develop high voltage. This completes the start-up of the TV.

The Picture-in-Picture circuitry differs in that the main video signal flow does not pass through the Picture-in-Picture circuitry. The Picture-in-Picture video signal source comes from the AV switch directly and the child picture replaces the main picture at the Jungle IC when called for. In addition to the start-up and PIP sections being different, the blanking stages are slightly different from previous Sony chassis.

AC In

When this TV set is plugged in, the oscillator power supply stage begins working immediately to output these voltages:

1) +135Vdc;
2) Audio voltage at +23Vdc (33Vdc unloaded);
3) Standby 5Vdc
4) +10Vdc which will become the 9V switched line and a 5Vdc line (unswitched) for the Micon IC.

Therefore, in this TV set, as soon as the set is plugged in, various voltages are available throughout the entire set.

Start up

When the TV set is turned on, either from the front panel power switch or from the remote control, Syscon/Micon IC001 outputs a HIGH on the relay line to the 9V regulator inside the power supply block. This 9V regulator switches ON and outputs regulated 9V to the Jungle IC. The Jungle IC in turn starts the crystal, horizontal and vertical oscillator stages.

The horizontal signal is applied to the flyback transformer to develop deflection for horizontal scanning and high voltage. The flyback manufactures high voltage for the picture tube (28kV on the 27" TVs), and the following ("scan derived") voltages necessary for TV operation:

1) +12V is used for the vertical output stage and pincushion stages;
2) -15V is also used for these same two sections;
3) +200V is used for the G2 screen grid of the picture tube;
4) +5,500Vdc Focus voltage at the G4 picture tube.

The vertical oscillator signal is used for both vertical deflection and for system control's serial data timing (VTIM). System controls needs these vertical timing pulses in order to output serial data during the vertical interval and not during the picture time so there is no interference.

Blanking

Once the Jungle IC receives 9V, the next step after the starting of the horizontal oscillator is to unblank the picture and permit the video to output the IC to the picture tube's cathodes. In order to do this, three main conditions must be met:

1) the vertical deflection must be proven operational;
2) the serial data and clock must be input
3) the IK signal from the picture tube must also be input when white balance is completed.

OCP
POWER SUPPLY
+135VDC SOURCE
AUDIO (+23VDC)SOURCE
+9V (SW)
H OFF
EEPROM IC002
STBY 5V
RELAY
SPKMT
IR
REC
POWER
IC001 SYSCON/ MICON
I-VP
BUFF.
SCLK
SER DAT
SER CLK
IC351 JUNGLE IC
+9V
VTIM
CLK
DATA
V DRIVE
H DRIVE
E/W
R
G
B
IK
Y
R-Y
B-Y
YUV
RGB OUTPUT
CRT
EY, ERY EBY YUV (SW)
C
Y
IC1001 D/A CONV.
TV BLK
AUDIO CONTROL
IC561 VERT OUT
FB
PROT
Q501
Q502
PIN
FBT
H
28Kv
-15V
200V
+12V
VD YOKE
HD YOKE
SPKMT
MUTE
SPKR
IC461 OUT
AUDIO OUT
IC1401 PROCESS
AUDIO
CONTROL
AUDIO CONT./ SW.
IC3303 P IN P PROC.
U V Y
IC3301 CHROM. DEC
CHBLK
2 CK BLK
ANT. SW.
DATA
CLOCK
ENABLE
DET
OUT
L,R
TU102 TUNER
TU101 SUB TUNER
ANT. SW.
TV OUT
MUTE
COMB
IC261 AV SW.
C
Y
SUB V
MUTE
DE-EM.AUDIO
SUB V
VIDEO
P MUTE
MUTE
MONITOR OUT

AA-2 CHASSIS BLOCK DIAGRAM

CTV24J8 535 3 5 97

Main Video Path

The main video takes the following path between the main TU102 tuner and the picture tube:

- Tuner TU-102 outputs 1.5V p-p of video to A/V switch IC261.
- IC261 outputs 2V p-p video to the Comb filter. The comb filter then returns 2V p-p of luminance (Y) and chroma (C) to IC261.
- A/V switch IC261 selects luminance and chroma from either the tuner or external video ("S") input and outputs them to the Jungle IC351.
- The Jungle IC outputs 2Vpp RGB signals to the RGB output stage which then amplifies the RGB signals to 180Vpp level and applies them to the three cathodes of the picture tube.

PIP Path

This signal begins at the sub tuner, TU-101, and gets mixed in with the main picture at the Jungle IC351 before outputting to the picture tube. The signal chain is as follows:

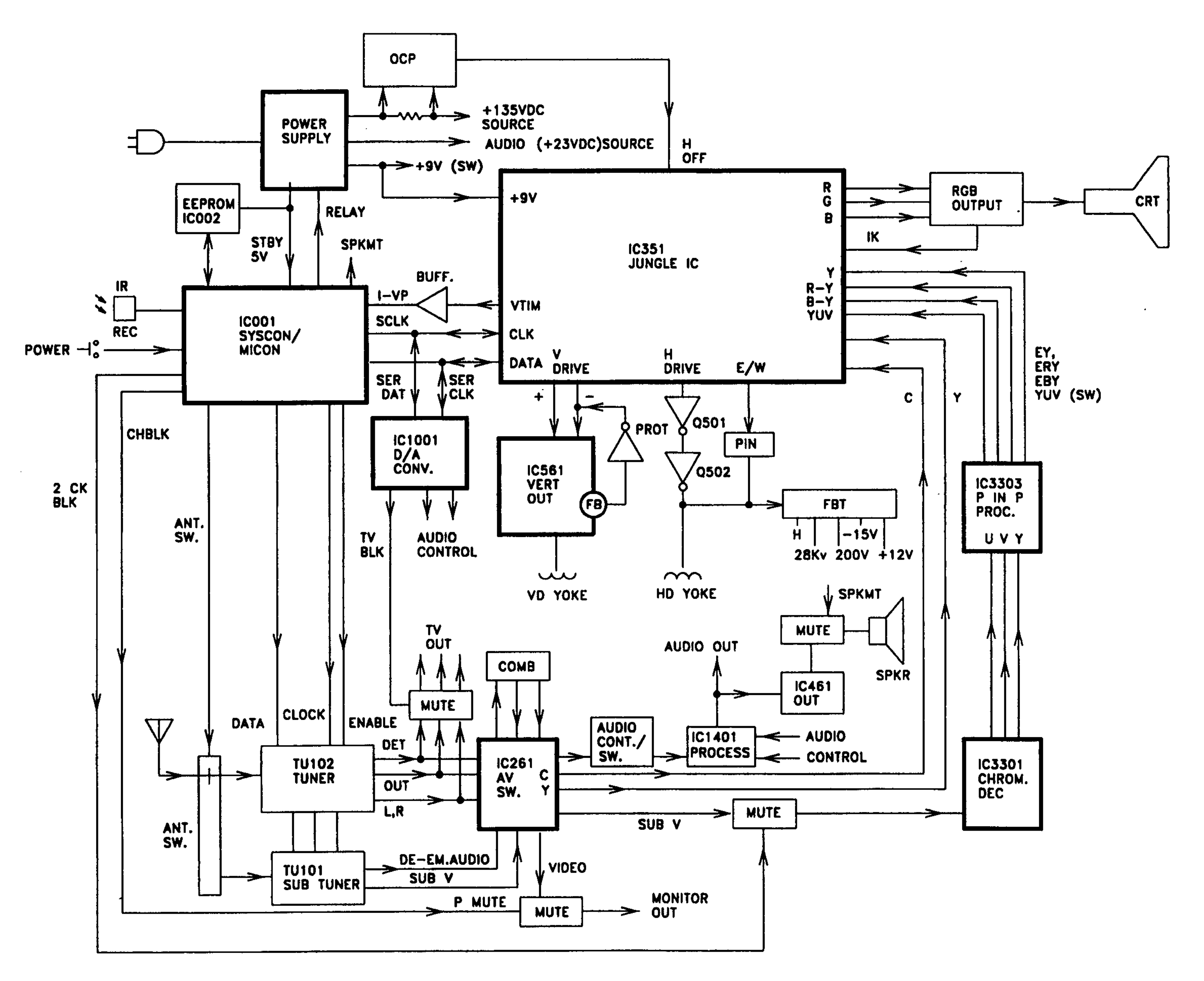
1. Sub tuner PU-101 outputs 2V p-p of video from the sub V line to A/V switch IC261.
2. A/V switch IC261 outputs 2V p-p at the sub V line (child picture) through a mute transistor. The mute transistor is activated momentarily at channel change. 2Vp-p goes to the Chroma Decoder IC3301.
3. Chroma decoder IC3301 outputs R-Y, B-Y and Y at 1.5V p-p with the color bar signal input to the PIP processor IC3303.
4. PIP processor IC3303 has Input = 1.5V p-p, output = 0.7V p-p. Output is to Jungle IC351.
5. Jungle IC351 has various inputs besides the main one. The child picture input is 0.7V p-p only when the PIP is switched ON from the remote control. PIP IC3303 also outputs a YUV signal to the Jungle IC351. It is used by IC351 to select either the main picture or the small child picture. When this YUV line goes HIGH, the main picture is switched out of the signal path and the small PIP child picture is switched in. The output of Jungle IC351 is the RGB signal applied to the output transistors on the CRT board.
6. RGB output transistor stage. The RGB signal that is input is amplified and applied to the cathodes of the picture tube for display.

Audio

The audio path starts at the tuner and ends at the speaker. It takes the following path:

1. Main tuner TU102 outputs the left and right signal to

   A/V switch IC261, paralleling the video path.
2. A/V switch IC261 outputs left and right channels to discrete Audio Control matrix stage.
3. The discrete Audio Control matrix stage makes the surround and SRS matrix signal. The selection is chosen by a switch which is not shown and output to the tone control processor IC1401.
4. Processor IC1401 changes the volume, bass, and treble based on the customer's requirements. Control comes from the microprocessor IC001 via the serial data line. The audio output goes to both the TV's rear panel audio output terminal and the Output IC461.
5. Output IC461 generates the current necessary to drive the speakers. Its output can be muted by customer request from the menu. System controls will output a HIGH at the SPK MT line which inputs the audio output IC and stops the speaker sound. This permits the sound from the variable output terminal to still feed TV sound to the hi-fi stereo system that it is connected to. It also can be switched to fixed output with the speaker muted.



AA-2 CHASSIS BLOCK DIAGRAM

CTV24J8 535 3 5 97

POWER SUPPLY / POWER ON

Overview

Unlike previous Sony direct view TV sets, when this TV is plugged in to AC, almost all the DC voltages are output from the DC to DC converter type power supply. The only one that is switched ON at turn ON is the +9V line. Therefore, as long as the set is plugged in, all supply voltages output this power supply, except for the +9V output to the Jungle IC.

WARNING - Before plugging in the power supply board, discharge the 2 large main capacitors, C606 & C607 or the 5 lead 9V regulator IC641 will be destroyed. These parts are all located on the on the power supply board.

Standby Power

120V AC is applied to Bridge Rectifier D602 through common mode rejection transformer T601 and T602 at plug in. R623 is a current limiting surge resistor to prevent blowing a fuse at plug in when main caps C606 and C607 would represent a momentary short before they charged. R603 and C626 in parallel with R603 are used to reduce the AC and DC potential between the chassis ground and the AC earth ground. This reduces noise (C626) and voltage differences (R603) between the 2 grounds that may arc over (carbonize) the main transformer during a lightning strike entering at the antenna/cable lines or at the video input. The bridge rectifier D602 outputs 340Vdc to the oscillator circuit consisting of Q601 and Q602. Capacitors C607 and C606 are the voltage doubler and filter capacitors for this DC voltage. Resistors R606 and R605 divide the voltage equally across the two capacitors. Fusible resistor R607 is designed to open if there is a short or heavy current demand in the Q601, Q602 oscillator circuit/load.

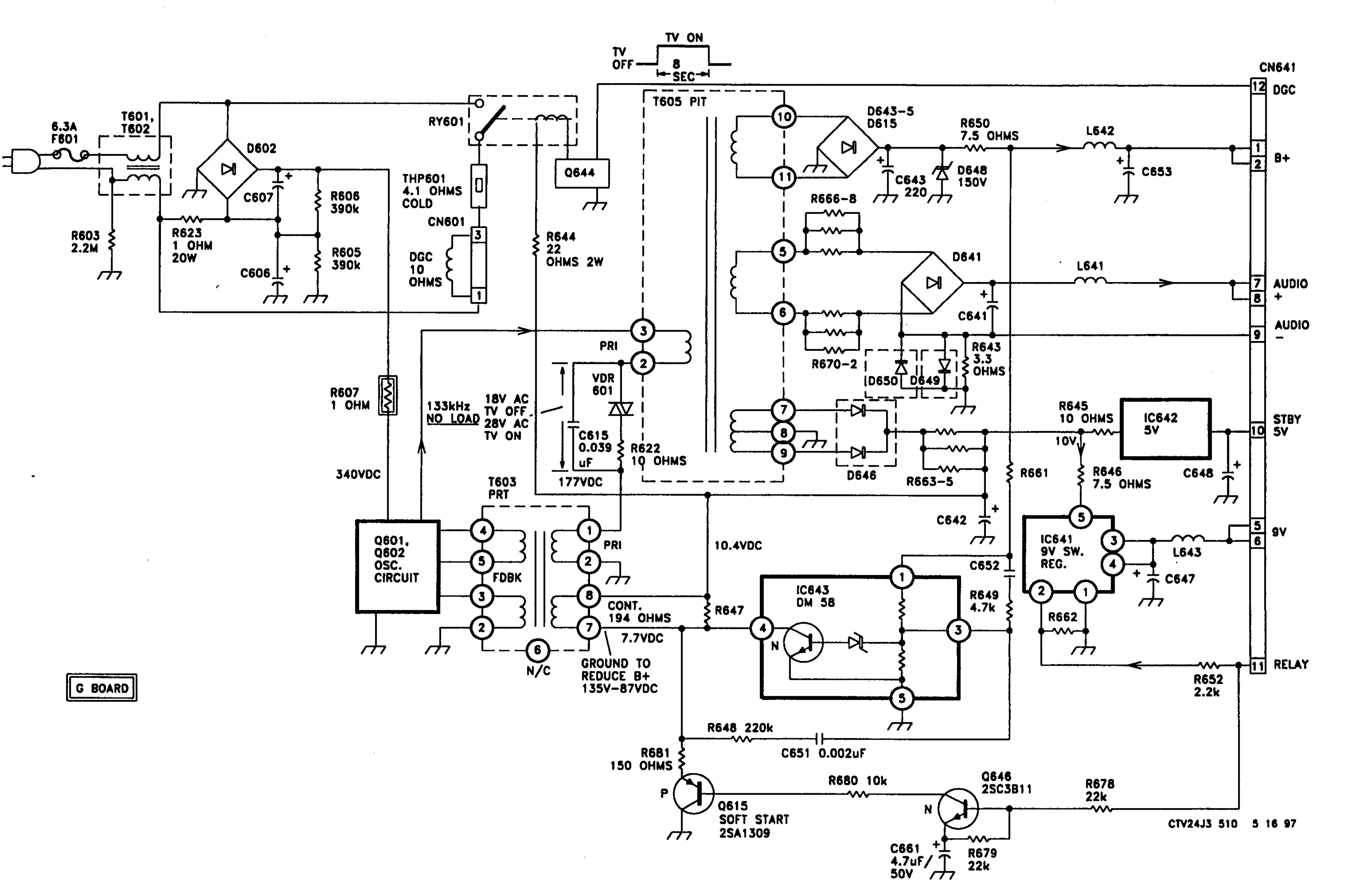
Once Q601 and Q602 receive voltage, the circuit oscillates with the aid of feedback transformer T603. The output of the oscillator circuit is a square wave, applied to the primary of transformer T605/pin 3. It's path continues from T605/pin 2 through the capacitor C615 and through the primary of the feedback transformer T603/pin1 to hot ground at T603/pin 2. The VDR601 prevents a heavy current demand from exceeding the voltage rating of C615, which could occur during a short in the load. The feedback transformer T603 has two secondary feedback windings at pins 4 & 5, and 2 & 3. These are used to sustain the oscillation of Q601 and Q602.

Main transformer T605 has three secondary windings. The first secondary outputs 135V B+ from T605/pin 10 and 11 after the D643-45 bridge rectifiers. The B+ voltage is passed through fusible resistor R650 and L642 to output CN641/pin 1 and 2. Be aware of the 150V zener diode on this B+ path. It is designed to short-circuit if the voltage climbs above 150V. The instant short-circuit will in turn prevent damage in the TV set, and shortly open fusible resistor R607, that feeds B+ to the oscillator circuit, shutting OFF the TV.

Another T605 secondary feeds 23Vdc to the audio stages (33Vdc unloaded). This AC voltage that is output pins 5 and 6 is fused by parallel resistors R666 to R668, and R670 to R672 at the output of bridge rectifier D641. The 23V output is filtered by the L641 choke and capacitor C641 before outputting 23V to connector CN641/pin 7 & 8. Resistor R643 and clamping diodes D650 and D649 are designed to raise the ground of the audio line above chassis ground to prevent ground noise from being picked up by the audio section.

T605 winding at pins 7,8 and 9 provides standby 5V to the Micon/Syscon microprocessor IC001, and 9V to the Jungle IC. The AC voltage that outputs T605/pins 7 & 9 is full wave rectified by D646, fused by resistors R663 to R665, and filtered by capacitor C642. This 10Vdc is split into two paths. First it is applied to 5V regulator IC642 to output regulated standby 5V from connector CN641/pin 10. This 10V is also applied to the 9V switching regulator IC641, as well as the B+ regulating control circuitry of the power supply.

The 9V switching regulator IC641 will only output 9V with an input HIGH at pin 2. This HIGH input comes from Micon / Syscon IC001 when powered ON.



POWER SUPPLY/POWER ON

SONY AA-2 TV Chassis Power Supply Output Voltages - load unplugged							
Primary (gnd = C606 neg end)			Secondary (gnd = E at output socket CN641/pin 3,4)				
Variac controlled AC input Voltage	AC Current (no load)	Oscillator Frequency	135Vdc B+ Voltage	9V output (switched)	Audio * no load	Stby 5V	135V B+ output with soft start Q645 shorted
20Vac	160ma AC	57 kHz	67Vdc	0Vdc	30Vdc	3.45Vdc	31Vdc
30Vac	323ma AC	53 kHz	110Vdc	0Vdc	30Vdc	5Vdc	37Vdc
36Vac	342ma AC	53 kHz	135Vdc	0Vdc	33Vdc	5Vdc	39Vdc
40Vdc	287ma AC	55 kHz	135Vdc	0Vdc	33Vdc	5Vdc	39Vdc
50Vac	188ma AC	61 kHz	135Vdc	0Vdc	33Vdc	5Vdc	54Vdc
120Vac	76ma AC	133 kHz	135Vdc	0Vdc	33Vdc	5Vdc	113Vdc

* 23 Vdc with power supply (loaded) connected and set running - no sound output.

Regulation

Regulation is achieved by monitoring the 135V B+ line and using it to control the frequency of the oscillator circuit. By changing the frequency of the oscillator circuit, the voltage at the secondary of the main power transformer T605 will change correspondingly, either decreasing or increasing to bring the voltage back to 135Vdc. The heart of the regulation circuit consists of IC643 and feedback transformer T603. The 135V B+ that is output from the secondary is sampled at IC643/ pin 1. This is applied internally to a voltage divider which drops the voltage down to 2.5V and applies it to the circuitry within, to control the current flowing from pin 4 to ground. The regulation loop works this way: If the 135Vdc B+ rises, the 2.5V at pin 3 proportionally begins to rise, turning on the transistor within IC643 a little bit harder. This increases the current through the feedback transformer T603's control winding at pin 8 through pin 7 and through IC603/pin 4 to ground. As more current flows through this control, or cross field winding, the effective inductance of this transformer decreases, causing the oscillator connected to it to increase in frequency. The increase in oscillator frequency moves further beyond the primary transformer T605's resonate frequency, causing its efficiency to decrease, thus lowering the secondary voltage, bringing the 135V B+ line back to 135V.

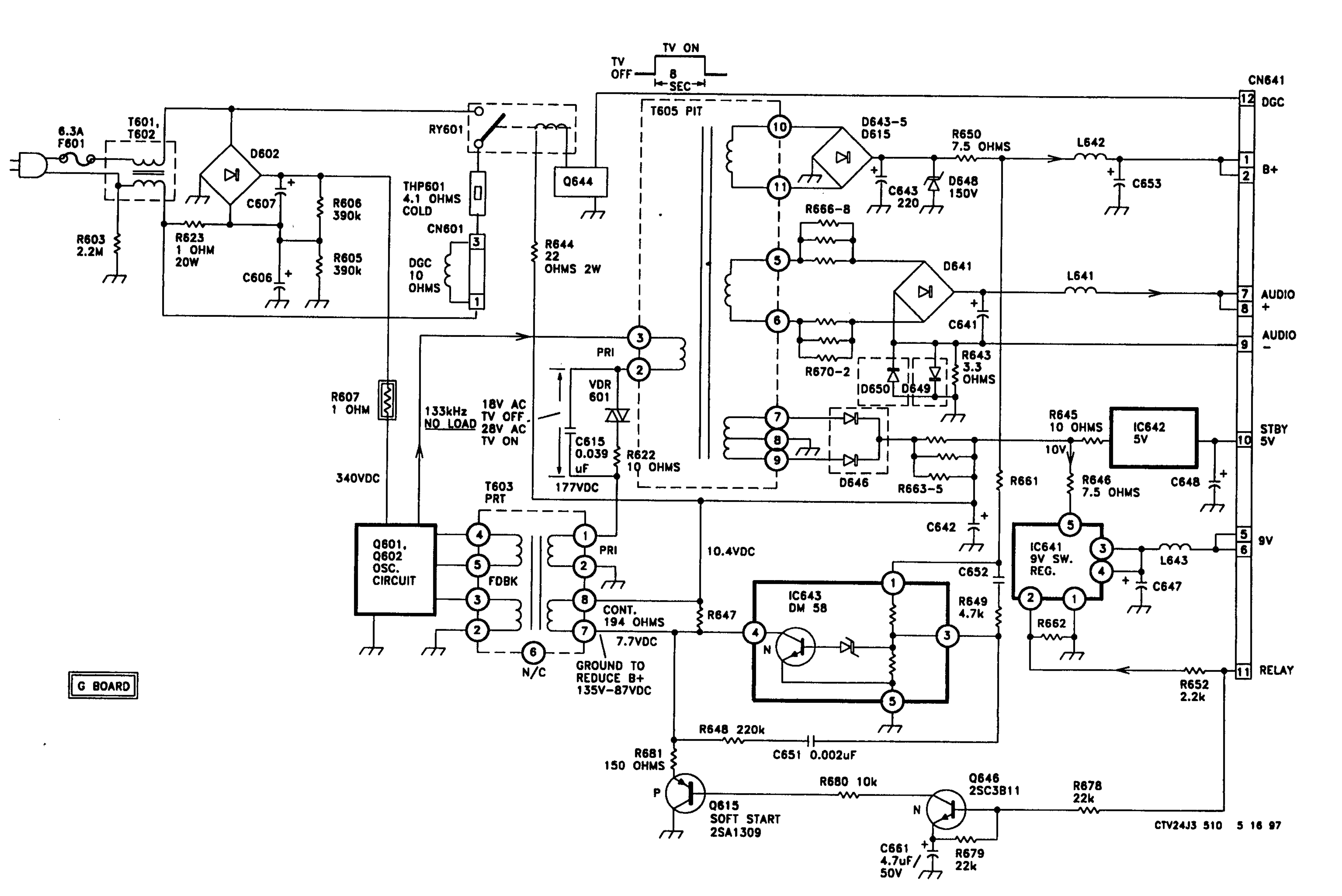
In the event of shutdown, to reduce the B+ voltage by defeating parts of this regulating stage, ground pin 7 of feedback transformer T603. This will reduce the 135V B+ in a working TV set down to 87Vdc. This ground bypasses the regulator IC643, as well as the printed circuit foil patterns that feed the 135Vdc to it. When the 135V line drops to a reasonable level and shutdown no longer occurs, then it is safe to conclude that the IC is not getting the proper voltages or the IC itself is defective so it can not regulate.

Power ON

When the set is powered ON, either from the remote or from the front panel push button, the microprocessor IC001 (not shown) outputs a HIGH which is applied to relay input CN641/pin 11 to the 9V switched regulator IC641/pin 2. This HIGH turns on the regulator and permits it to output regulated 9V at pins 3 & 4. This switched +9Vdc is filtered by capacitor C647 and inductor L643 before it outputs from CN641/pins 5 & 6 to the Jungle IC. Once the Jungle IC receives this 9V, it will power up the horizontal oscillator and high voltage sections to begin the TV set operation, since all the other voltages are already powered.

Degaussing

The degaussing circuitry is turned ON whenever the set is powered ON. The circuitry utilized is: the degaussing coil, a thermistor, and a relay, which is connected into the microprocessor IC001 (not shown).



POWER SUPPLY/POWER ON

When the set is turned ON, the microprocessor IC001 outputs a HIGH, not only to the 9V switching IC641/pin2, but also to the degaussing coil relay through a separate port. This HIGH from that separate port enters the power supply connector CN641/pin 12 and gets applied to relay driver transistor Q644, turning it ON, which in turn energizes the relay. Once the relay contacts close, power is applied through the degaussing coil and the 4 ohm (cold) thermistor. It takes just about four seconds for the thermistor to heat up and decrease the amount of current to the degaussing coil. The degaussing is effectively finished at this time.

However, the relay does not disengage until after the microprocessor receives a final completion command from the Jungle IC telling it everything is OK. This final communication coincides with the ending of the blinking front panel timer light that begins to blink when the Jungle IC sends out a busy signal. Therefore in normal operation, eight seconds after the set is powered ON, the picture tube has warmed up, the Jungle IC sends out an OK (not busy) signal, the timer light stops blinking, and the degaussing coil relay disengages.

Troubleshooting - Dead Set

If the 6.3 amp fuse F603 is open, check the bridge rectifier and filter capacitors D602, C607 and C606, as well as the thermistor and degaussing coil relay contacts for short circuits.

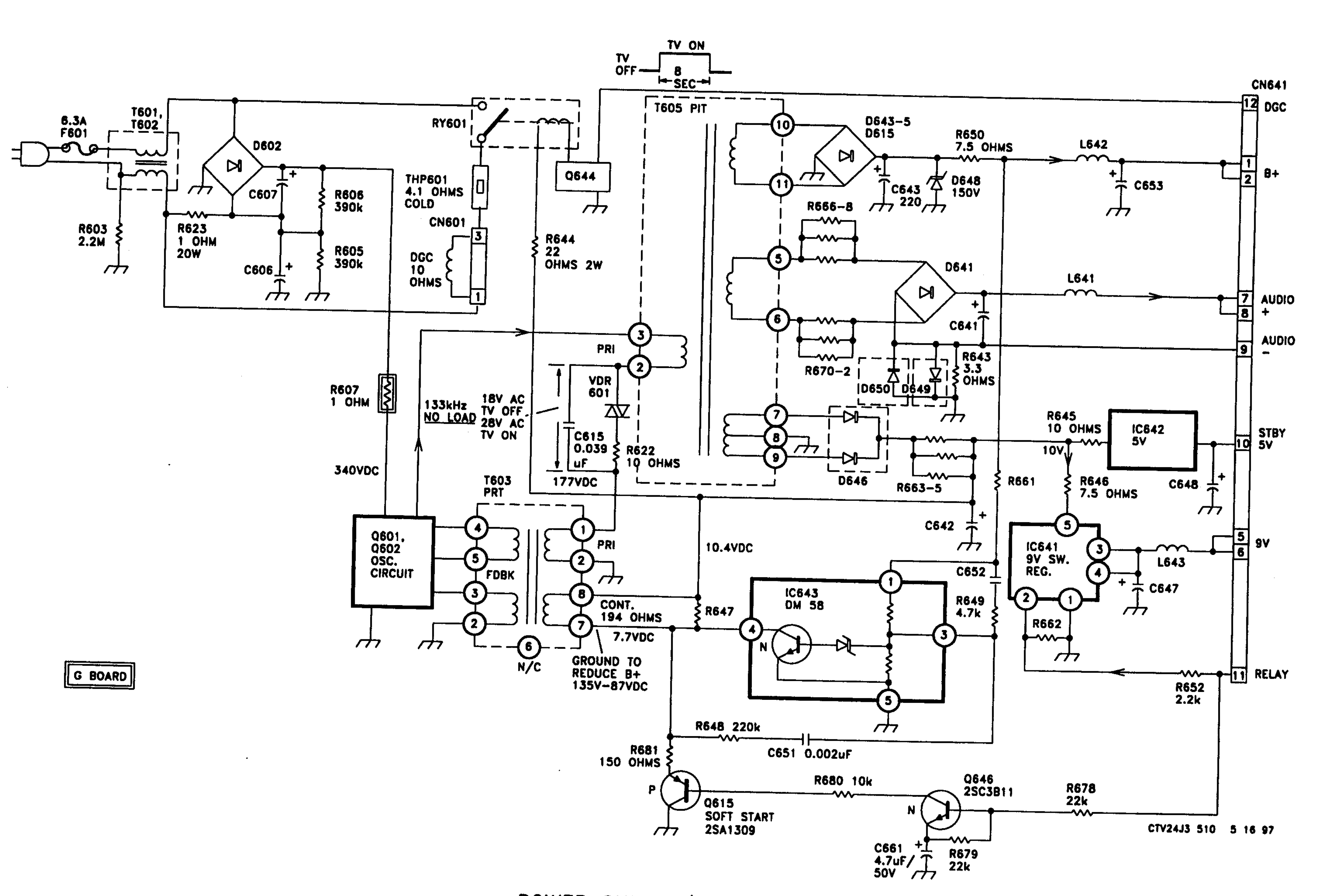
If fusible resistor R607 in series with the oscillator circuit is open, then check not only the oscillator transistors themselves, Q601 and Q602, but also the zener diode at the B+ secondary D648, for short circuits. After replacing these parts, unplug the power supply board and operate it separately (unloaded). On all Sony Direct View TV sets, the power supply will run without a load. This is not true for projection TV sets, which must be loaded at all times.

With the power supply separated from the TV set, it can be tested using an isolated Variac, a DVM, and an oscilloscope.

The oscillator will start with as little as 5Vdc applied to it, in lieu of the 340Vdc that is normally applied to the oscillator circuit. This DC input voltage can be controlled with the AC Variac. The oscilloscope can monitor the output at the primary of the main power transformer T605/pin 3. It should be a symmetrical square wave with the DC voltage at the junction of the oscillator transistors equal to half that of the applied B+ voltage if the waveform is symmetrical. In other words, if there was 10V applied to the oscillator circuit, you would measure 5 Vdc on a DVM if there is a waveform and it is symmetrical. An oscilloscope would show the presence of a symmetrical square wave with the first half of the cycle having an amplitude of 5v above the 5 volt line and the second half of the cycle having an amplitude of 5v below the 5 volt line, thus creating a 5Vdc average level. A lower or higher voltage indicates a defect in the basic oscillator circuit. Also, a low voltage could indicate a short circuit in the VDR601, which would load down or reduce the voltage at the junction or output of the oscillator circuit to T605.

Therefore after replacing defective components, you can use this method to check this power supply stage. Just monitor B+ and junction voltages as you bring up the Variac voltage. Make sure the B+ doesn't rise above 135V. The Variac current should also be monitored (see chart for normal AC current). The moment B+ begins to rise above +135Vdc, the regulator circuit should take over and begin keeping that voltage at 135V. For testing purposes, if you must run the power supply without protection zener diode D648, be careful that you never exceed the 160V rating on the B+ filter capacitor. IMPORTANT: Don't forget to discharge C606 and C607 before plugging in the power supply board, as described in the overview in this section.

Typical AC Power consumption - KV27V35	
Standby (pwr OFF)	0.180 Amp AC
Power ON - Video	0.97Amp AC
Power ON - Snow	1.16 Amps AC
Power ON - Color bars	1.496 Amps AC

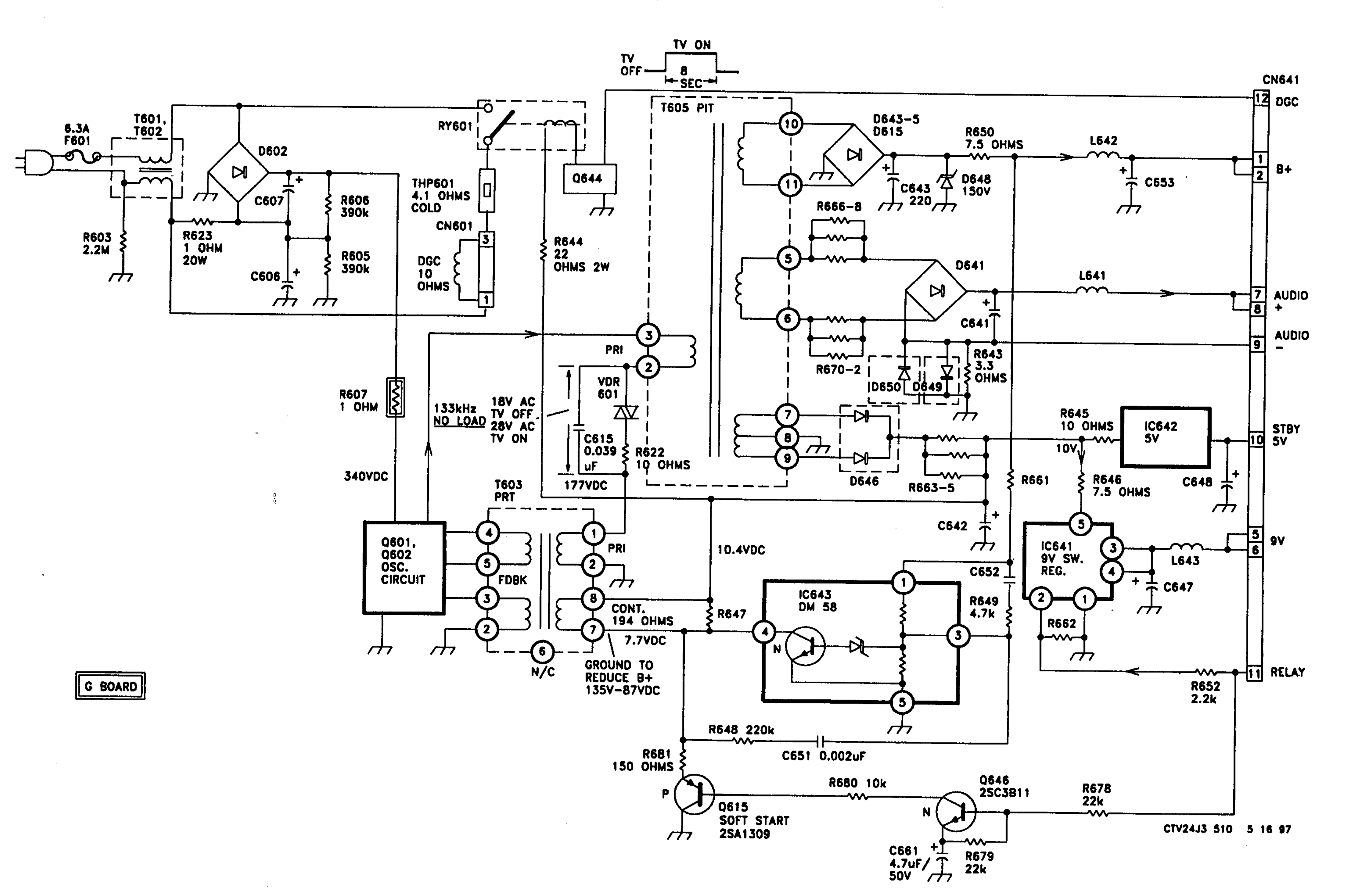


POWER SUPPLY/POWER ON

Troubleshooting - Low B+ Voltage

This can be caused by either something loading down the power supply or the power supply regulator section is not functioning itself. If possible, remove the power supply board from its load and operate it separately. It should function and regulate to the voltages given in the chart below. If the voltages are still low with the power supply board unplugged (the loads have been unsoldered in unpluggable sets), then measure the voltage at feedback transformer T603/pin 7. If this voltage is lower than the normal 7.7Vdc, it indicates that the circuitry before this point is defective. Suspect IC643 and its associated components. A higher than normal voltage at feedback transformer T603/pin 7 indicates a problem in the feedback transformer itself, resonate capacitor C615, the main transformer T605, or secondary load.

Resistance Measurements at the Load end of the power supply socket CN1641 (Power Supply board unplugged)		Load Current TV ON, 120V AC
CN1641/pin number	Resistance	Current
1,2 (135V B+)	38k	341mA = video 500mA = snow 676mA = bars
3,4 (Gnd)	0 ohms	Ground
5,6 (Sw +9V)	130 ohms	913mA
7,8 (Audio)	10.6 Meg ohms	53 mA = mono 95 mA = stereo
10 (Stby +5V)	4K ohms	72 mA = start up 66 mA = run
11 (Relay / ON com)	4.5 Meg ohms	
12 (Degauss transistor)	4.5 Meg ohms	



POWER SUPPLY/POWER ON

POWER SUPPLY OSC. CIRCUIT

Start

The power supply oscillator will begin functioning as soon as DC voltage is applied to it. The oscillator circuit consists of transistors Q601, Q602, feedback transformer T603, and the main power transformer T605. Voltage comes into the oscillator stage from a bridge rectifier, D602, when plugged into 120V AC. The output of the bridge rectifier and voltage doubler combination consisting of the two capacitors C607 and C606, outputs approximately 340V to the oscillator circuit through fusible resistor R607. The DC voltage is applied to Q601/collector, as well as its base through series resistors R615 and R612.

As the voltage at the base increases, so does its emitter by transistor action. As this voltage increases, current flows from Q601/C-E through the primary of transformer T605/pin 3 and out pin 2. It continues through C615 as the main path through feedback transformer T603/pin 1 to ground at pin 2. Current flowing through this path produces a magnetic field, creating current flow in the main power transformer T605 secondary windings and in transformer T603 feedback winding. A positive pulse feedback signal from T603/pin 4 is applied to Q601/base, turning it ON harder until it saturates. At the same time, a negative going pulse is output T603/pin 3, which is applied to Q602/base. This keeps Q602 turned OFF, so it is not in the circuit during the first half of the oscillator cycle.

Current no longer flows in this primary path when Q601 is fully saturated (emitter = collector voltage at 340V), and C615 is fully charged to 340Vdc. When there is no longer a change in the magnetic field, the magnetic field stored in the primary of both transformers T603 and T605 will collapse, causing a reverse voltage. When the field collapses, the polarity of the voltages that are output from the feedback transformer are reversed, causing a negative voltage to appear at Q601/base, shutting it off; and a positive voltage to Q602/base, turning it ON. When Q602 turns ON, it discharges the 340V stored in capacitor C615. The voltage at the junction of the two transistors, Q601/emitter and Q602/collector, then decreases from 340V down towards 0, completing the other half of the oscillator cycle. This resultant sine wave signal is present at the primary of T605 and is induced into its secondaries to produce the various voltages required for operation of the TV set.

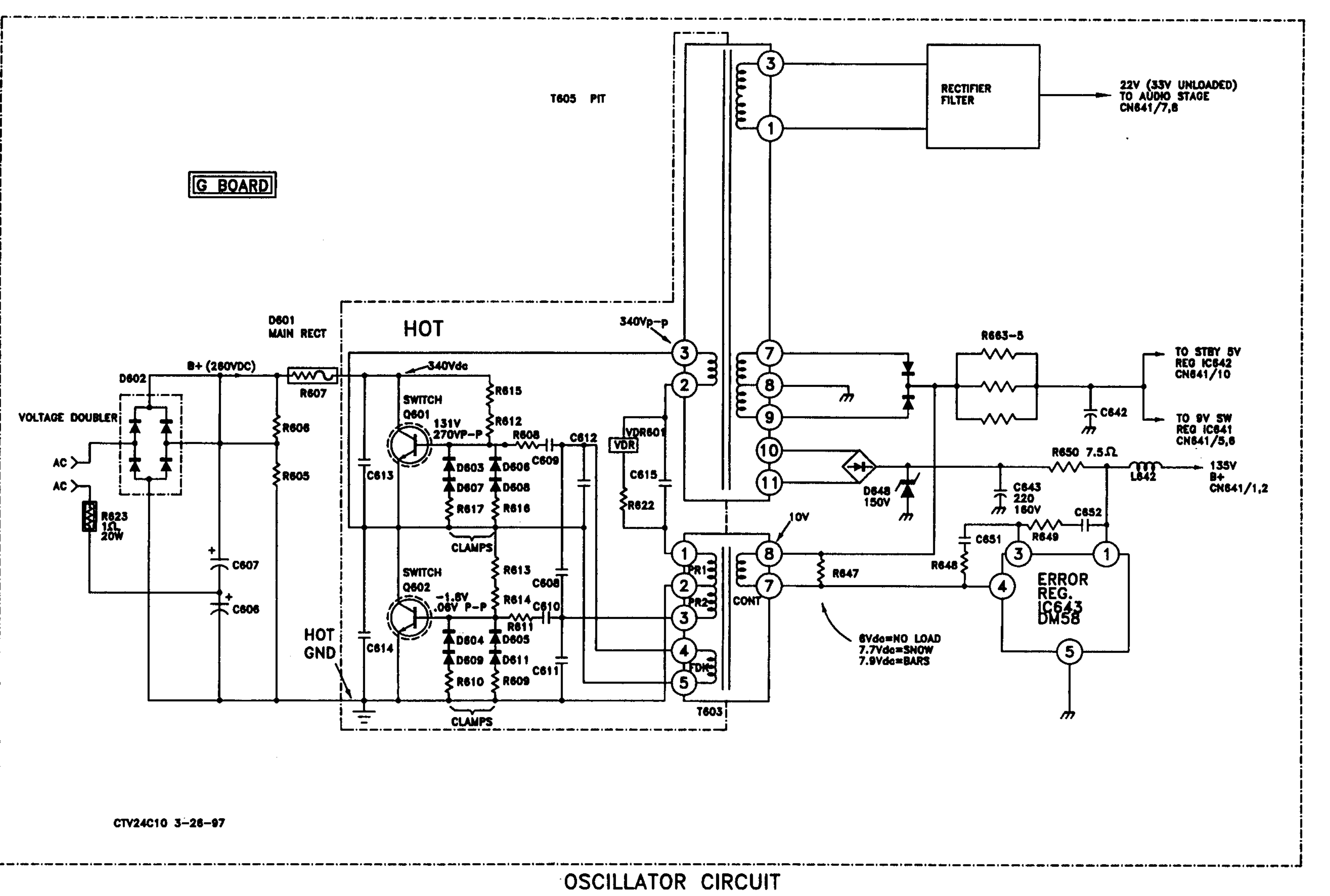
Regulation is achieved by monitoring the +135Vdc B+ line, at error regulator IC643/pin 1. IC643 monitors this line and varies the current through the control winding of T603 (pins 8 and 7), which is connected to IC643/pin 4. If an increase in B+ voltage is sensed, the voltage at error regulator IC601/pin 4 is reduced, this increases the current through the control winding. By increasing the current through the control winding of transformer T603, the frequency of the oscillator changes. The efficiency or output of the main power transformer T605, changes with frequency. Thus, the transformer becomes less efficient causing the output voltage to reduce to the correct +135Vdc level. This process continues to regulate the 135 Volt supply.

Protection

Q601 and Q602 are the oscillator transistors that are subjected to voltage spikes from external power line and internal transients, developed through inductors that have expanding and collapsing magnetic fields. These spikes can easily arc over the junctions of the transistors, causing them to fail by exceeding their voltage ratings. Therefore, it is essential to reduce these voltages. There are three different ways used in this oscillator circuit to do this:

1. Capacitors C613 and C614 are used to reduce spikes applied to the emitter junction of the two oscillator transistors. When a voltage spike appears, it is used to charge these capacitors, reducing the voltage so it doesn't exceed the breakdown voltage of the transistor.

2. Diodes at the base of oscillator transistors prevent reverse voltage from appearing at these transistor's base-emitter junction. Diodes at the base of oscillator transistors prevent reverse voltage from appearing at these transistor's base-



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emitter junction. A reverse voltage between 8 to 10V will puncture the base to emitter junction of a transistor. So by placing these diodes accordingly, reverse bias is clamped to a safe level.

3. Voltage spikes from the feedback transformer T603 should be smoothed out. This is achieved with the aid of filter capacitors C612, C611 and C608.

Intermittent failure of oscillator transistors:

VDR601 is designed to protect main capacitor C615; so the voltage applied across it does not exceed its breakdown voltage. These voltage occur during normal oscillator operation. If protection VDR601 passes a lot of current & gets leaky or opens, (usually caused by lightning), R622 will open. This can cause intermittent failures of Q601 and Q602, the same as if protection capacitors C611, C608 and C612 would open up. Capacitors C613 and C614 protect the oscillators transistors from abnormally high spikes, such as during lightening strikes. They could be open and the oscillator circuit will work fine, but the oscillator circuit will be damaged at the next lightening storm since there is no longer any protection.

Instant failure of oscillator transistors:

The diodes at the base of the two transistors are necessary all the time, therefore, if a group of them opens, there will be instantaneous failure of the transistors at turn ON. However these diodes usually get leaky after a severe lightening storm, causing an imbalance in the oscillator waveform and offsets the DC voltage at Q601/emitter.

Check these diodes on high current /voltage VOM for high reverse resistance leakage.

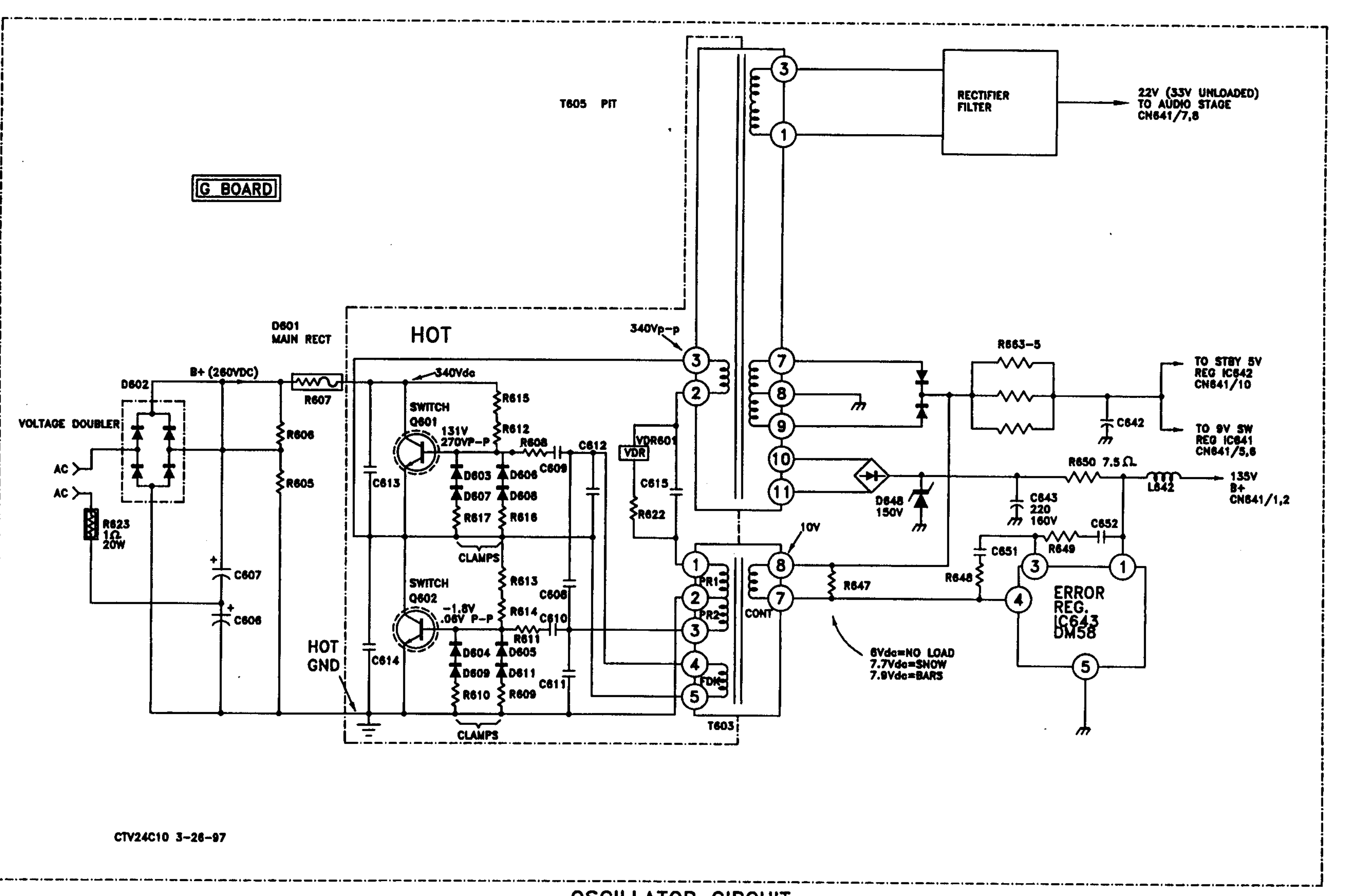
SONY AA-2 TV Chassis Power Supply Output Voltages - load unplugged							
Primary (gnd = C606 neg end)			Secondary (gnd = E at output socket CN1641/pin 3,4)				
Variac controlled AC input Voltage	AC Current (no load)	Oscillator Frequency	135Vdc B+ Voltage	9V output (switched)	Audio * no load	Stby 5V	135V B+ output with soft start Q645 shorted
20Vac	160ma AC	57 kHz	67Vdc	0Vdc	30Vdc	3.45Vdc	31Vdc
30Vac	323ma AC	.53 kHz	110Vdc	0Vdc	30Vdc	5Vdc	37Vdc
36Vac	342ma AC	53 kHz	135Vdc	0Vdc	33Vdc	5Vdc	39Vdc
40Vdc	287ma AC	55 kHz	135Vdc	0Vdc	33Vdc	5Vdc	39Vdc
50Vac	188ma AC	61 kHz	135Vdc	0Vdc	33Vdc	5Vdc	54Vdc
120Vac	76ma AC	133 kHz	135Vdc	0Vdc	33Vdc	5Vdc	113Vdc

* 23 Vdc with power supply (loaded) connected and set running - no sound output.

Repair

Testing and repair of this stage is based on this oscillator stage that will begin to oscillate with as little as 5Vdc applied to it instead of the normal 340V. Using a Variac, DC voltmeter and possibly a scope, we can test and monitor the oscillator's condition as the voltage is increased to this oscillator stage.

1. Plug the set into an isolated AC Variac transformer, with an AC ammeter, voltage turned down to 0VAC.
2. Place a voltmeter and scope at the emitter of Q601 or the collector of Q602.
3. Bring up the AC Variac voltage so that 5Vdc appears at the collector of Q601 or the fusible resistor R607.
4. The oscillator should start and there should be a square wave at the junction of the two transistors at Q601/emitter. The waveform should be symmetrical and if it is symmetrical, then 2.5Vdc, half the applied voltage of 5Vdc will appear at that junction. The oscilloscope is used to determine if a waveform is present and to verify symmetry.



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5. As the voltage is increased on the Variac, the voltage at the junction of the two transistors will always remain at half the B+ level, as long as the oscillator section is outputting a symmetrical waveform.
6. While bringing up the voltage on the Variac, you should always monitor the AC current consumption as well, to make sure it is not excessive. This is because you're only monitoring the center voltage which determines if the waveform is balanced. You also need to determine if the total consumption of the power supply is abnormally high or abnormally low revealing a short (load) to the power supply.

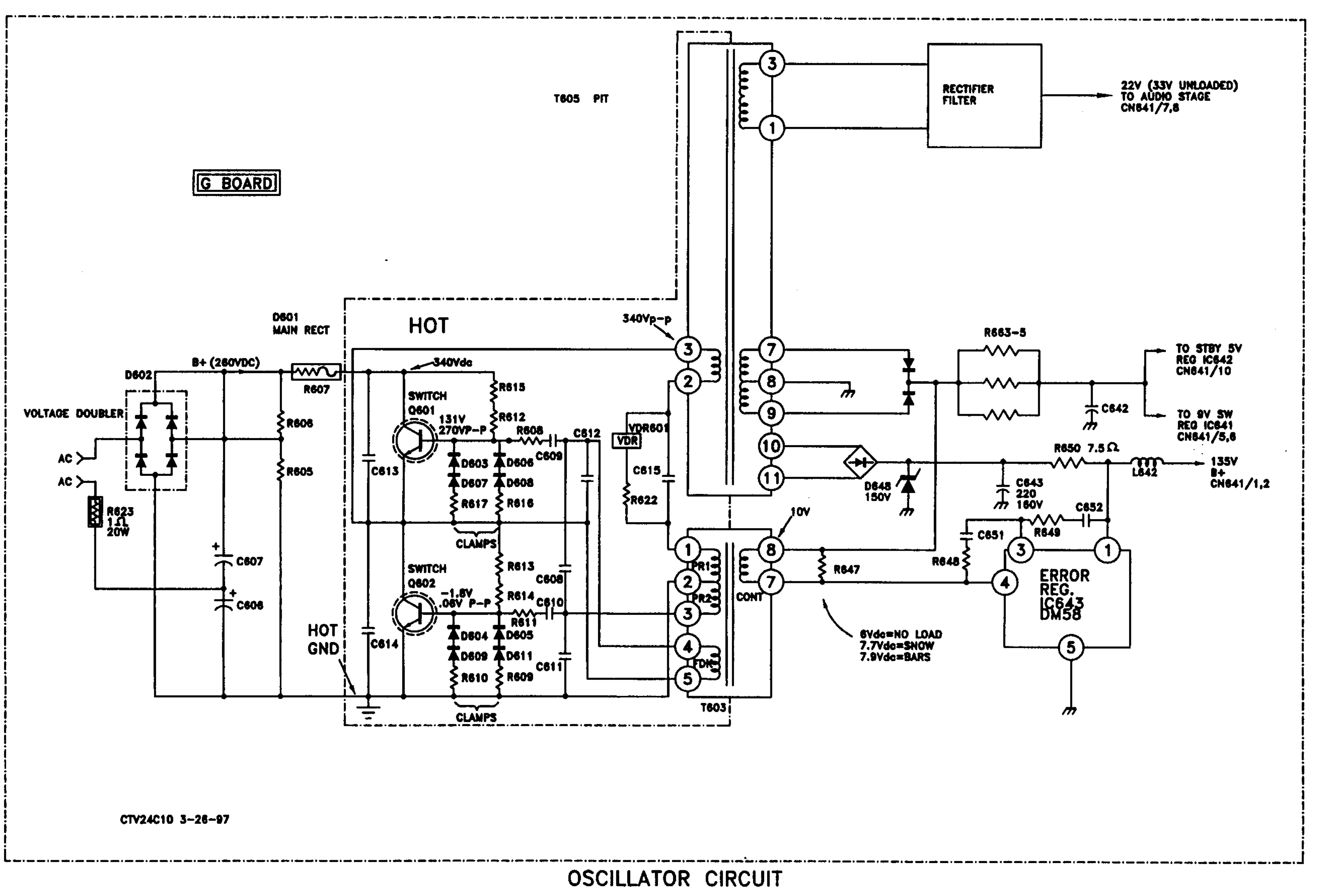
In this testing method, the Variac voltage can be brought up to the full line voltage so that 340V will appear to the oscillator circuit and half that voltage (+170Vdc) at the junction of the two transistors, proving that the oscillator waveform is symmetrical. It is best to do this with the power supply board only. With it plugged to the set, Syscon may turn ON the TV at about 50Vac (when Syscon gets Stby 5Vdc operating power). To prevent this, the 9V choke L643 can be removed.

Non-Symmetrical Waveform

If the voltage between the two transistors (Q601/E & Q602/C) is not half B+ at any point of the testing (above), it means the waveform is not symmetrical. A non-symmetrical waveform is the result of an imbalance of the oscillator stage. This can be caused by leakage in any one of a number of components in this stage. Common failures are the 50V C611, C612 and C608 capacitors at the bases of the oscillator transistors, as well as the VDR601. Coupling capacitors C609 and C610 have also been found leaky, upsetting the bias, causing the imbalance as well. They usually get leaky and cause failures of Q601 and Q602 minutes after turn on at 120Vac because one of the transistors gets abnormally hot and the other one tends to assume the load for as long as it can until they both fail.

SONY AA-2 TV Chassis Power Supply Output Voltages - load unplugged							
Primary (gnd = C606 neg end)			Secondary (gnd = E at output socket CN1641/pin 3,4)				
Variac controlled AC input Voltage	AC Current (no load)	Oscillator Frequency	135Vdc B+ Voltage	9V output (switched)	Audio * no load	Stby 5V	135V B+ output with soft start Q645 shorted
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